DOCUMENT RESUME

ED 175 901 TM 008 985

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TITLE Multivariate Analysis of Child Achievement Data in the Parent Education Follow Through Program.
INSTITUTION North Carolina Univ., Chapel Hill.
SPONS AGENCY Office of Education (DHEW), Washington, D.C.
PUB DATE Apr 79
GRANT G007701691
NOTE 24p.: Paper presented at the Annual Meeting of the American Educational Research Association (63rd, San Francisco, California, April 8-12, 1979)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Academic Achievement; *Compensatory Education Programs; Elementary School Mathematics; Evaluation Methods; Parent Child Relationship; Parent Influence; *Parent Participation; *Parent School Relationship; Primary Education; *Program Evaluation; Reading Achievement
IDENTIFIERS *Parent Educator Program; *Project Follow Through

ABSTRACT

A prior national evaluation suggested that children enrolled in the Parent Education Follow Through Program performed equal to or better than non-Follow Through children on several achievement subtests. The present study involved multivariate analysis of first through third grade achievement data in three Parent Follow Through communities. The three communities were a large southwestern urban area, a large southern urban area, and a small midwestern city. Two groups of children were included from each community: Parent Education children and comparison, or Non-Parent-Education children. The evaluation findings supported and elaborated the results of prior external evaluations of the programs. For the most part, the Parent Education groups performed equal to or better than the comparison groups on measures of reading and mathematics achievement. In the smaller midwestern community, difference did favor the comparison group, but it could be demonstrated that this was due to the unavailability of an appropriate comparison group. In addition, there was some indication that achievement test scores of program children in this community converged on those of the more advantaged comparison children by third grade. The authors concluded with a suggestion that multiple evaluation techniques be utilized to accurately assess such program outcomes. (Author/RC)

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Multivariate Analysis of Child Achievement Data in the Parent Education Follow Through Program

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Introduction

There has been a substantial amount of research literature indicating that the major source of a student's pattern of and motives for achievement, as well as his or her personality structure, is the home in which he or she grows up (Gordon, 1977). The behavior and attitudes of the parents, as well as the nature of the physical setting and materials provided, have a direct impact on the child's behavior before and during the school years. The school is another source of a child's intellectual and personality development. The nature of the curriculum, the mode of teacher behavior, and the classroom ecology all influence not only immediate behavior, but also patterns of behavior for the future.

The combination of the home and school environments, requires not only its own internal changes but also changes in its interaction. Also, it requires charges in all the social, economic, and political agencies and systems which impinge on it. This interaction of environments on agencies can be viewed as a transactional approach across systems or as a Community Impact Model. This model recognizes that parents do not operate in isolation, that what goes on within the family is influenced by a variety of forces outside the family, and that the family in turn plays a role in influencing a variety of social forces (Gordon, 1978).

Paper prepared for the annual meeting of the American Educational Research Association, San Francisco, California, April 8-12, 1979.

This study was supported by a grant from the United States Office of Education (Grant No. G00-77-01691) to the University of North Carolina at Chapel Hill.

One such program which utilizes and operates upon the conceptual framework of the Community Impact Model is the Parent Education Follow Through Program. The major features of the Program, developed by the late Ira J. Gordon, include the active involvement of parents in the education of their children. Basic to these features is the assumption that parents exert a major influence upon the intellectual development of their children, and that these parents serve as a vehicle by which new learning behaviors are passed on. To this end, the program targets the home environment because it is assumed that success in this environment will lead to success in other environments as well (Gordon, 1978). The program stresses six major roles of parent involvement: (1) teachers of their own children, (2) paid paraprofessionals, (3) decision makers and policy advisors through Policy Advisory Committees, (4) adult learners of new skills, (5) recipients of information, and (6) volunteers in the classroom. The parents' involvement in these roles facilitates their influence upon the program and also results in the enhancement of their own and their children's development.

Since this program implements this multifaceted type of Community Impact Model, it follows that multiple types of evaluation should be performed on the program's data in order to best analyze the effectiveness of it. This suggestion is further supported by David Rindskopf (1978) in his recent research which focused upon the secondary analysis of Head Start and Title 1 data. He stated that "With perfect information from flawlessly designed and executed evaluations of social programs in short supply, evaluators are urged to look to gathering many kinds of evidence and analyzing it by multiple methods to reduce the incidence of erroneous conclusions." (p. 75) Therefore, the focus of this paper is upon one type of the multifaceted

evaluation mentioned above; namely, the analysis of the child achievement data from the Parent Education Follow Through Program. This type of evaluation may be considered one of the most traditional and conventional ways of examining an education program.

Most recently, examination and evaluations of the Follow Through Program have been done which specifically utilized different kinds of statistical procedures applied to child achievement data. These studies were conducted on a national level by Abt Associates (1977) and by the research team of House, Glass, McLean, and Walker (1977). A review of these studies follows.

One study, performed by Abt Associates (1977), summarized the effects of the Parent Education Follow Through Program by utilizing a univariate analysis of covariance. The Abt study's summary of effects across all cohort streams showed that this program compared quite favorably with the other Follow Through models. In addition, it was reported that Parent Education Follow Through children performed better than or equal to non-Follow Through children on several subtests of the Metropolitan Achievement Test (Abt Associates, 1977).

Another analysis of the Follow Through child achievement data was performed by the Center for Instructional Research and Curriculum Evaluation, University of Illinois, under the directorship of Ernest House (House et al., 1977). The House et al. report " . . . consists of a description and judgment of the context of the Follow Through Evaluation, its measurement problems, its data analysis problems and final assessment of the Abt findings" (House et al., 1977, p. 9). In doing this, the group conducted a reanalysis of the Metropolitan Achievement Test data. Their results indicated that Parent Education Follow Through Program students were performing comparably

with both Follow Through children from programs emphasizing "basic skills" and their non-Follow Through counterparts.

A third examination of the program's child achievement data has been completed by the Parent Education Follow Through Program Sponsor staff (Gordon, Olmsted, Rubin & True, 1978). The Sponsor supervised the collection and analyses of achievement data from each of the ten communities that it serves. The selection of the achievement batteries for each community was made by local school administrators and local evaluation personnel which resulted in a certain degree of nonstandardization. This nonstandardized character of the testing situation made varied types of data analyses essential.

The sponsor analysis of the child achievement data from the Parent Education Follow Through Program is addressed in this paper. These data were chosen as the first type of evaluative information to be presented in this symposium because of the sophistication and conformation of these data to the traditional expectations of the federal agencies which fund programs of this sort. These data satisfy the contingencies set forth by this program's funding agency and concomitantly satisfy local administrators and parents by directly showing the educational progress that has been made.

More specifically, the child achievement data in three of the Parent Education Follow Through communities were analyzed by multivariate statistical procedures. Analyses were performed to determine if there were any differences in performance on standardized achievement tests between Parent Education Follow Through children and a group of comparison children. It must be noted that problems concerning appropriate comparison groups exist when evaluations are done in field settings. In many cases, for instance, the comparison

groups used in the analyses that are reported here are nonequivalent to the Parent Education Follow Through Program children. In most instances, the Parent Education Follow Through group consists of all those students from low socioeconomic backgrounds eligible for the program. The comparison group usually comes from middle and upper socioeconomic status groups. In addition, some of the comparison students are receiving additional educational services from supplementary programs. Due to these factors, we conclude that results are considered favorable to the program when they indicate that the Parent Education Follow Through children perform as well as or better than the comparison children.

Methods

Child achievement data from three communities served by the Parent Education Follow Through Program (PEFTP) in which comparison groups existed, were analyzed using multivariate analysis of variance procedures. In all instances the program has been fully implemented for the past ten years. The data included in this study were collected during the 1977-78 academic year. The design of the evaluation would be considered quasi-experimental, since there was no random assignment to treatment conditions (Campbell & Stanley, 1966).

Subjects

The communities included in this evaluation were a large, southwestern urban area (Community A); a large, southern urban area (Community B); and a small midwestern city (Community C). The children included were those students with complete achievement data for grades one through three within each community. Two groups of children were investigated in each community.

They were the Parent Education (PE) children and the comparison (NPE) children. For the most part, the Parent Education Follow Through Program children came from lower socioeconomic groups than the comparison children. Attempts were made, within each community, to select children who are comparable to the PEFTP children. In many cases, however, the comparison groups were considered non-equivalent at best.

Instruments

The selection of an appropriate achievement battery involves many conditions, most of which are locally determined and locally known. Thus, the sponsor has attempted to tie into already existing testing programs. This position has permitted the selection of batteries appropriate for local conditions and also operates to reduce the amount of time spent in test administration. However, a certain degree of nonstandardization across communities has resulted.

Appropriate levels of the Iowa Test of Basic Skills (ITBS) were used as an achievement measure in Community A for grades one through three. Community B administered the Metropolitan Readiness Test (MRT) in grade one and the Science Research Associates Achievement Series (SRA) test in grades two and three. The Metropolitan Achievement Test (MAT) was administered in grades through three in Community C.

Statistical Analysis

Separate statistical analyses were performed on the achievement data for grades one through three by community. No attempt was made to collapse grade levels across communities due to the multiplicity of different achievement instruments used in the three communities. Multivariate analyses of Covariance (MANCOVAs) adjusting for pretreatment differences were performed for each grade

level using the posttest raw scores as the dependent variables. The $p < .05$ significance level was used in all statistical analyses included in this study.

Results

Community A. The results of the MANCOVAs performed on the posttest ITBS subtest scores in grades one through three in Community A are reported in Table 1. Raw scores on the reading and mathematics subtests were analyzed in each grade. Descriptive statistics for Community A are included in Table 2.

The MANCOVA performed on the subtests of the ITBS in grade one suggests a significant difference between the two groups (Pillai's Trace = .21633, $F(6,217) = 9.98$, $p<.05$). Follow up univariate analyses indicates a significant difference on the Spelling subtest favoring the Parent Education group ($p<.05$). It should be noted that the Parent Education students had a slight advantage on tne pretest scores.

The MANCOVA performed on the subtests of the ITBS in grade two indicates a significant difference between the Parent Education and comparison groups (Pillai's Trace = .10587, $F(6,166) = 3.28$, $p<.05$). Univariate tests were completed indicating Parent Education favoring effects on the Spelling and Reading subtest of the ITBS ($p<.05$). Comparison group favoring effects were found on the Word analysis subtest ($p<.05$).

The MANCOVA completed on the grade three posttest scores on the ITBS indicated significant differences between the two groups (Pillai's Trace = .32532, $F(6,132) = 5.57$, $p<.05$). Univariate tests were completed indicating Parent Education favoring effects on the Spelling and Math Problems subtests ($p<.05$). The comparison group showed an advantage on the Reading Subtest ($p<.05$).

In summary, it appears that the Parent Education children are performing equal to or better than the comparison children on measures of reading and

mathematics. There appears that in most instances where there were significant differences, these differences favored the Parent Education Follow Through children. It is disturbing to note that there is a mixture of positive and negative results in grades two and three. However, it is encouraging that the Parent Education Follow Through children are for the most part doing as well as their more advantaged peers.

Community B. The results of the MANCOVAs conducted on the posttest MRT and SRA subtest scores for grades one through three are included in Table 3. Raw scores on the reading and mathematics subtests were analyzed in each grade. Descriptive statistics for all grades in Community B are reported in Table 4.

In grade one, the MANCOVA conducted on the MRT posttest scores indicated a significant difference between the groups (Pillai's Trace = .27650, $F(8,129) = 6.16$, $p<.05$). Univariate analyses suggest differences on the School Language, Listening, Quantitative concepts and Quantitative Operations subtests, all favoring the Parent Education group ($p<.05$).

The MANCOVA completed on the grade two posttest raw scores of the SRA indicated that there were no significant differences between the Parent Education and comparison groups (Pillai's Trace = .02593, $F(6,143) = 0.63$, $p>.05$). Consequently, no follow up univariate tests were performed.

In grade three, the MANCOVA conducted on the posttest scores of the SRA yielded significant differences between the groups (Pillai's Trace = .43413, $F(4,60) = 11.51$, $p<.05$). Follow up univariate analyses indicated that there were significant differences favoring the Parent Education group on the Composite and Mathematics subtests ($p<.05$).

In general, it appears that the Parent Education children in Community B are performing better than the comparison children in mathematics and reading achievement. Significant differences were discovered in the first and third

grade comparisons, where all differences favored the Parent Education group.

Community C. The results of the MANCOVAs performed on the posttest MAT subtest scores for grades one through three in Community C are reported in Table 5. Raw scores on the mathematics and reading subtests were analyzed in each grade. Descriptive statistics for Community C are included in Table 6.

In grade one, the MANCOVA performed on the MAT posttest scores indicated significant differences between the groups (Pillai's Trace = .36626, $F(4,107) = 15.46$, $p<.05$). Follow up univariate tests show significant differences on the Word Knowledge, Word Analysis, Reading and Mathematics subtests, all favoring the comparison group ($p<.05$).

The MANCOVA performed on the MAT posttest raw scores in grade two indicated significant differences between the Parent Education and comparison groups (Pillai's Trace = .19559, $F(7,73) = 2.54$, $p<.05$). Univariate tests indicate significant differences favoring the comparison group on the Math Computations subtest ($p<.05$). The remaining univariate tests were nonsignificant ($p>.05$).

In grade three, the MANCOVA performed on the posttest scores of the MAT indicated that there were no significant differences between the Parent Education and comparison group (Pillai's Trace = .09010, $F(7,89) = 1.26$, $p>.05$). No follow up univariate tests were conducted.

Although the reading and mathematics results are disappointing they do seem to indicate some degree of convergence between the scores of the Parent Education and comparison group. It should be noted that the comparison children in this community usually represent middle and upper income level families (Ware, Greenwood, and Breivogel, 1977). Therefore, it is encouraging to find that the differences between the two groups in achievement scores have been reduced to nonsignificance by the second and third grade. However, the true treatment effects of the Parent Education Follow Through Program in Community C could be more accurately estimated if more equivalent control groups could be found.

Discussion

These evaluative results indicate that the Parent Education Follow Through Program has made a difference in the achievement test performance of its students when compared to non-program students. For the most part, the Parent Education groups perform equal to or better than the comparison group on measures of mathematics and reading achievement. In cases where differences favor the comparison group, it can be demonstrated that this result was due to the noncomparability of the comparison group. Unfortunately, in Community C, where this appears to be a problem, there was no other more appropriate comparison group available. However, there is some indication that in Community C the achievement test scores of the program children converge on those of the more advantaged comparison children by the third grade. In Community A and Community B, where appropriate comparison groups existed, the analysis of achievement test scores favor the Parent Education groups in most significant results.

Overall, the evaluative results reported here compare favorably with the results of the national evaluation of the Follow Through Program related to the Parent Education Follow Through Program. As stated earlier in this paper, the national evaluation suggested that children enrolled in the Parent Education Follow Through Program performed equal to or better than non-Follow Through children on several subtests of the Metropolitan Achievement Test (Abt Associates, 1977). In addition, the reanalysis of the achievement data from the Follow Through national evaluation indicated that Parent Education Follow Through Program children perform as well as children from more "basic skills" Follow Through models (House et al., 1977). The evaluation findings discussed in this paper appear to support and elaborate on the results discovered in previous external evaluations of the program.

Implications

Few educational programs limit their objectives to a single knowledge of skill area. Rather, the objectives usually refer to multiple outcome variables. This is true of Follow Through in general and of the program discussed in this paper in particular. The multifaceted nature of this program and its objectives has implications for the statistical procedures that are used for evaluation.

If the multiple outcome variables are statistically related to one another, then a multivariate procedure should be used, otherwise, differences may go undetected, or it may appear that groups differ on several variables when, in fact, the variable measures are assessing related skills or knowledge. In the analyses discussed in this paper, sets of related variables were treated simultaneously. We believe these multivariate analyses of variance procedures are appropriate.

Most Follow Through evaluations have relied upon univariate statistical procedures. In doing so, they have too often disregarded the empirically established relationships among dependent variables. This is not to imply that none of these procedures has been appropriate. We do, in fact, encourage and see advantages in using multiple statistical methods when there is a question about which one is most applicable. However, we believe there needs to be more coordination and description of these procedures than has generally been the case. If multiple methods are used for the same data sets, then the results obtained for the different methods should be reported and discussed. Obviously, there should be some justification for any procedure used and for which results are going to be reported.

Too often when multiple methods have been used, evaluators have described and reported results for only the approach which reflects most favorably on a particular program. This is not a legitimate practice and does not provide maximally useful information for program decision makers. In all evaluations,

there should be a rationale for each statistical procedure used, reporting all results obtained, and an interpretation and discussion of the results. When multiple statistical treatments are employed, there should be an explicit comparison of the related findings. The believability of the evaluation conclusions should depend to a considerable extent upon the comprehensiveness of this comparison.

No statistical procedure can offset the effects of an inadequate design, including an appropriate comparison group. The problem of inappropriate comparison groups was evident in the interpretation of results for Community C. In that community, when differences were found, they were consistently in favor of the comparison group. Our tendency is to disregard these findings as reflecting negatively on the relative effects of the Parent Education Follow Through Program. Based upon the documented relatively higher socio-economic status of the comparison children, this is probably a reasonable interpretation. However, such an interpretation is no substitute for an appropriate comparison group.

All of the considerations mentioned above suggest a very real need for alternative types of evaluation to be performed on the Parent Education Follow Through program. Due to the comprehensive nature of the program, it follows that multiple evaluative techniques should be utilized in order to accurately assess any outcomes. This paper presented one of these techniques and the following papers in this symposium will report and describe other types of evaluative procedures conducted by this program.

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Table 1:

Community A: MANOVA results for the two groups on the posttest ITBS subtest scores in grades 1, 2, and 3.

Grade	Test	df	F	P
1	Overall	(6,217)	9.98	$p<.05$
	Vocabulary	(1,222)	0.04	$p>.05$
	Word Analysis	(1,222)	0.73	$p>.05$
	Reading	(1,222)	1.58	$p>.05$
	Spelling	(1,222)	11.45	$p<.05$
	Math Concepts	(1,222)	0.52	$p>.05$
	Math Problems	(1,222)	0.19	$p>.05$
2	Overall	(6,166)	3.28	$p<.05$
	Word Analysis	(1,171)	14.87	$p<.05$
	Vocabulary	(1,171)	3.45	$p>.05$
	Reading	(1,171)	6.76	$p<.05$
	Spelling	(1,171)	7.27	$p<.05$
	Math Concepts	(1,171)	2.04	$p>.05$
	Math Problems	(1,171)	1.20	$p>.05$
3	Overall	(6,132)	5.57	$p<.05$
	Vocabulary	(1,137)	0.20	$p>.05$
	Reading	(1,137)	5.40	$p<.05$
	Spelling	(1,137)	5.38	$p<.05$
	Usage	(1,137)	1.55	$p>.05$
	Math Concepts	(1,137)	0.07	$p>.05$
	Math Problems	(1,137)	4.43	$p<.05$

Table 2:

Community A: Descriptive statistics for the subtests of the Iowa Test of Basic Skills administered in grades 1, 2, and 3 during the 1977-78 school year.

Grade 1		N	Vocabulary	Word Analysis	Reading	Spelling	Math Concepts	Math Problems
PE	$\bar{X}$	102	13.77	32.86	34.46	14.70	20.41	13.85
	SD		(6.11)	(6.67)	(10.62)	(5.15)	(4.52)	(3.77)
NPE	$\bar{X}$	147	11.80	28.95	29.41	11.59	19.08	11.65
	SD		(5.27)	(7.70)	(9.25)	(4.19)	(4.50)	(4.39)
Grade 2								
PE	$\bar{X}$	116	14.88	31.87	36.30	17.61	16.87	14.70
	SD		(6.23)	(9.66)	(11.45)	(6.87)	(5.34)	(4.61)
NPE	$\bar{X}$	115	14.00	32.95	34.96	15.64	16.90	13.97
	SD		(6.89)	(9.29)	(11.77)	(5.75)	(6.68)	(3.88)

Grade 3		N	Vocabulary	Usage	Reading	Spelling	Math Concepts	Math Problems
PE	$\bar{X}$	112	12.42	12.40	19.85	17.89	14.46	12.36
	SD		(5.69)	(5.26)	(8.03)	(7.79)	(5.02)	(4.74)
NPE	$\bar{X}$	91	11.95	13.40	21.20	12.67	14.51	10.31
	SD		(5.72)	(6.27)	(8.50)	(5.97)	(6.29)	(4.65)

Table 3:

Community B: MANCOVA results for the two groups on the posttest MRT and SRA subtests in grades 1, 2, and 3.

Grade	Test	df	F	P
1	Overall	(8,129)	6.16	p<.05
	Beginning Consonants	(1,136)	0.35	p>.05
	Sound Letter Consonants	(1,136)	0.55	p>.05
	Visual Matching	(1,136)	0.03	p>.05
	Finding Patterns	(1,136)	2.21	p>.05
	School Language	(1,136)	7.87	p<.05
	Listening	(1,136)	11.78	p<.05
	Quantitative Concepts	(1,136)	12.04	p<.05
	Quantitative Operations	(1,136)	4.79	p<.05
2	Overall	(6,143)	0.63	p>.05
3	Overall	(4,60)	11.51	p<.05
	Composite	(1,63)	10.18	p<.05
	Reading	(1,63)	3.25	p>.05
	Language Arts	(1,63)	0.64	p>.05
	Mathematics	(1,63)	12.85	p<.05

Table 4:

Community B: Descriptive statistics for the subtests of the Metropolitan Readiness Test and the Stanford Research Association Battery administered in grade 1, 2, and 3 respectively during the 1977-78 school year.

Grade 1		N	Beginning Consonants	Sound Letter Consonants	Visual Matching	Finding Patterns	School Language	Listening	Quantitative Concepts	Quantitative Operations
PE	$\bar{X}$	89	10.98	14.40	8.35	13.09	7.73	6.79	6.43	12.75
	SD		(2.45)	(2.55)	(1.74)	(2.47)	(1.99)	(1.73)	(1.73)	(2.38)
NPE	$\bar{X}$	109	10.15	14.15	8.03	11.69	6.53	5.29	4.80	10.89
	SD		(2.61)	(2.66)	(1.79)	(4.13)	(1.89)	(1.97)	(2.05)	(3.34)

Grade 2		N	Reading	Vocabulary	Language Arts	Spelling	Math Concepts	Math Computation
PE	$\bar{X}$	84	20.08	48.40	45.58	47.08	44.29	20.05
	SD		(3.88)	(30.35)	(27.83)	(30.20)	(30.14)	(4.66)
NPE	$\bar{X}$	59	18.56	45.09	41.13	47.02	49.76	18.26
	SD		(2.29)	(30.13)	(27.09)	(33.70)	(31.54)	(2.75)

Grade 3		N	Composite	Reading	Language Arts	Mathematics
PE	$\bar{X}$	62	24.44	35.98	51.63	25.15
	SD		(3.95)	(30.10)	(27.36)	(4.08)
NPE	$\bar{X}$	65	20.85	37.30	48.28	19.43
	SD		(4.86)	(28.15)	(30.85)	(4.04)

Table 5:

Community C: MANCOVA results for the two groups on the posttest MAT subtest scores in grades 1, 2, and 3.

Grade	Test	df	F	P
1	Overall	(4,107)	15.46	$p<.05$
	Word Knowledge	(1,110)	24.02	$p<.05$
	Word Analysis	(1,110)	18.02	$p<.05$
	Reading	(1,110)	4.46	$p<.05$
	Total Math	(1,110)	15.55	$p<.05$
2	Overall	(7,73)	2.54	$p<.05$
	Word Knowledge	(1,79)	0.20	$p>.05$
	Word Analysis	(1,79)	1.54	$p>.05$
	Reading	(1,79)	0.46	$p>.05$
	Spelling	(1,79)	0.04	$p>.05$
	Math Computation	(1,79)	5.46	$p<.05$
	Math Concepts	(1,79)	0.61	$p>.05$
	Math Problem Solving	(1,79)	1.96	$p>.05$
3	Overall	(7,89)	1.26	$p>.05$

Table 6:

Community C: Descriptive statistics for the subtests of the Metropolitan Achievement Test administered in grades 1, 2, and 3 during the 1977-78 school year.

Grade 1		N	Word Knowledge	Word Analysis	Reading	Total Math
PE	$\bar{X}$	84	22.37	28.73	22.17	37.01
	SD		(8.02	(8.80)	(9.06)	(9.53)
NPE	$\bar{X}$	32	30.57	36.34	27.84	46.16
	SD		(4.26)	(2.65)	(7.81)	(7.64)

Grade 2		N	Word Knowledge	Word Analysis	Reading	Spelling	Math Computation	Math Concepts	Math Problem Solving
PE	$\bar{X}$	77	23.87	26.06	28.14	22.81	20.56	25.33	21.87
	SD		(8.66)	(6.96)	(9.97)	(10.51)	(6.13)	(6.31)	(6.32)
NPE	$\bar{X}$	34	28.96	28.[illegible]	32.25	21.62	24.96	28.08	23.75
	SD		(7.19)	(5.90)	(9.76)	(6.98)	(5.74)	(5.23)	(6.67)

Grade 3		N	Word Knowledge	Reading	Language	Spelling	Math Computation	Math Concepts	Math Problem Solving
PE	$\bar{X}$	72	32.29	24.52	26.95	25.52	25.12	24.54	20.60
	SD		(9.53)	(8.99)	(9.19)	(10.86)	(6.95)	(6.97)	(4.79)
NPE	$\bar{X}$	34	34.29	26.17	27.12	29.21	26.92	26.29	23.87
	SD		(9.79)	(8.07)	(10.18)	(9.49)	(5.70)	(5.87)	(5.53)